

CLAIMS

1. An isostatic press for high pressure treatment
5 of a product having a temperature below 0°C, comprising
a pressure chamber adapted to contain a first pressure medium,
a container which is placeable in the pressure chamber and which is adapted to hold the product and a second
10 pressure medium,
the container being closable to keep the second pressure medium separated from the first pressure medium and being provided with a pressure transfer means for transfer pressure from the first pressure medium to the
15 second pressure medium, and the container comprising a body which is made of a material having low adiabatic heat emission relative to adjoining substances, so that the body from adjoining substances absorbs heat which is generated by adiabatic temperature rise during the high
20 pressure treatment.
2. An isostatic press as claimed in claim 1, wherein the body constitutes at least part of the container wall.
25 3. An isostatic press as claimed in claim 2, wherein the container wall comprises an inner wall round the outside of which a substance in the form of an insulation is arranged to counteract thermal transfer between the first pressure medium and the second pressure medium, the body
30 constituting at least part of the inner wall, said body counteracting that adiabatic heat emission from the insulation, due to compression during the high pressure treatment, thermally passes to the second pressure medium and the product.
- 35 4. An isostatic press as claimed in claim 3, wherein the container is arranged with an outer wall and the

insulation is arranged between the inner and the outer wall.

5. An isostatic press as claimed in claim 3 or 4,
5 wherein the inner wall of the container is essentially
rigid and at least part of the pressure transfer means of
the container is movably arranged relative to said inner
wall to enable a change of volume of the second pressure
medium for the purpose of eliminating a pressure differ-
10 ence between the first pressure medium and the second
pressure medium.

6. An isostatic press as claimed in any one of the
preceding claims, wherein the pressure transfer means
15 is arranged as a loose piston, preferably constituting
a closable lid on the container, adapted to transfer a
pressure change in the first pressure medium to the
second pressure medium and to separate the first pressure
medium from fluid communication with the second pressure
20 medium.

7. An isostatic press as claimed in any one of
claims 1-5, wherein the pressure transfer means is
arranged as a flexible membrane, preferably constitut-
25 ing a closable lid on the container, adapted to transfer
a pressure change in the first pressure medium to the
second pressure medium and to separate the first pressure
medium from fluid communication with the second pressure
medium.

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8. An isostatic press as claimed in any one of the
preceding claims, wherein a plurality of containers can
be placed in the same pressure chamber of the isostatic
press for simultaneous treatment of the product in each
35 container.

9. An isostatic press as claimed in claim 3 or any one of claims 4-8 in combination with claim 3, wherein the inner wall is made of metal, preferably stainless steel.

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10. An isostatic press as claimed in claim 3 or any one of claims 4-9 in combination with claim 3, wherein the inner wall has a thickness which is at least 5 mm, preferably 5-15 mm, particularly 8-12 mm.

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11. An isostatic press as claimed in claim 3 or any one of claims 4-10 in combination with claim 3, wherein the insulation is made of a polymer, preferably EPDM (ethylene propylene rubber) or natural rubber.

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12. An isostatic press as claimed in claim 3 or any one of claims 4-11 in combination with claim 3, wherein the insulation has a thickness which is at least 5 mm, preferably 5-15 mm, particularly 8-12 mm.

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13. An isostatic press as claimed in any one of the preceding claims, wherein a valve means is arranged on the container to enable discharge of a possible residual volume of air in the container when the container holds the product and the second pressure medium.

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14. An isostatic press as claimed in any one of the preceding claims, wherein the second pressure medium is a liquid with a freezing point below 0°C, such as ethanol or some other alcohol, or a mixture of water and alcohol.

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15. An isostatic press as claimed in any one of the preceding claims, wherein the first pressure medium is a liquid, preferably water or a mixture of water and alcohol, such as a mixture of water and glycol.

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16. A method for high pressure treatment of a product by means of an isostatic press comprising a pressure chamber adapted to hold a first pressure medium, comprising:

5 providing at least one closed container which holds a second pressure medium and a product whose temperature is below 0°C,

placing the container in the pressure chamber of the isostatic press,

10 pressurising the pressure chamber by means of the first pressure medium,

transferring a pressure change of the first pressure medium to the second pressure medium to subject the product held in the closed container to high pressure treatment,

15 and

keeping the temperature of the product below 0°C throughout the high pressure treatment by absorbing heat which is generated by adiabatic temperature rise during the high pressure treatment.

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17. A method as claimed in claim 16, further comprising keeping the product in a frozen state throughout the high pressure treatment.

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18. A method as claimed in claim 17, further comprising, if the product reaches a temperature where there is a phase change from solid phase to liquid phase, keeping the product frozen throughout the high pressure treatment by utilising consumption of melting heat.

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19. A method as claimed in any one of claims 16-18, further comprising counteracting thermal transfer between the first pressure medium and the second pressure medium by selecting a container provided with thermal insulation.

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20. A method as claimed in any one of claims 16-19, further comprising counteracting, during the high pressure treatment, by means of a body arranged in the container that emitted adiabatic heat from the insulation,
5 due to compression during high pressure treatment, thermally passes to the second pressure medium.

21. A method as claimed in claim 20, further comprising absorbing said emitted adiabatic heat from the
10 insulation by selecting a container where the body is positioned between the insulation and the second pressure medium, the body constituting at least part of the container wall.

15 22. A method as claimed in any one of claims 16-21, further comprising transferring the pressure of the first pressure medium to the second pressure medium by compressing the second pressure medium in the container so that pressure equalisation is achieved between the first
20 pressure medium and the second pressure medium.

23. A method as claimed in any one of claims 16-22, further comprising cooling the container and the second pressure medium, which preferably is performed simultaneously, to a temperature below 0°C, preferably between -5 and -30°C, such as -10 to -25°C.
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30 24. A method as claimed in claim 23, further comprising placing in the cooled container the product having a temperature below 0°C, preferably between -5 and -30°C, such as -10 to -25°C.

35 25. A method as claimed in any one of claims 16-24, further comprising discharging a possible residual volume of air from the container holding the product and the second pressure medium before the pressure chamber is

pressurised, preferably before the container is placed in the pressure chamber.

26. A method as claimed in any one of claims 16-25,
5 further comprising subjecting the product to high pressure treatment for 0.5-20 min, preferably 0.5-10 min, particularly 2-7 min.

27. A method as claimed in any one of claims 16-26,
10 further comprising subjecting the product to high pressure treatment at a pressure of 2000-15000 bar, preferably 2000-10000 bar, particularly 5000-7000 bar.

28. A method as claimed in any one of claims 16-27,
15 further comprising decompressing the high pressure press and then removing the container from the pressure chamber after the high pressure treatment.

29. A container adapted to subject, by means of an isostatic press, a product having a temperature below 0°C, which is placeable in the container, to high pressure treatment, comprising

25 a closure adapted to separate the inside of the container from the surroundings of the container,
a pressure transfer means for transferring pressure from the surroundings of the container to the inside of the container,

30 a body which is made of a material having low adiabatic heat emission relative to adjoining substances, so that the body from adjoining substances absorbs heat which is generated by adiabatic temperature rise during the high pressure treatment.

30. A container as claimed in claim 29, wherein the
35 body constitutes at least part of the container wall.

31. A container as claimed in claim 30, wherein the container wall comprises an inner wall round the outside of which a substance in the form of an insulation is arranged to counteract thermal transfer between the surroundings of the container and the inside of the container, the body constituting at least part of the inner wall, said body counteracting that adiabatic heat emission from the insulation, due to compression during the high pressure treatment, thermally passes to the inside 10 of the container.

32. A container as claimed in claim 31, wherein the container is arranged with an outer wall and the insulation is arranged between the inner and the outer wall.

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33. A container as claimed in claim 31 or 32, wherein the inner wall of the container is essentially rigid and at least part of the pressure transfer means of the container is movably arranged relative to said inner wall 20 to enable a change of volume of the inner volume of the container for the purpose of eliminating a pressure difference between the surroundings of the container and the inside of the container.

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34. A container as claimed in any one of claims 29-33, wherein the pressure transfer means is arranged as a loose piston, preferably constituting a closable lid on the container, adapted to transfer a pressure change of the surroundings of the container to the inside of the 30 container and to separate the inside of the container from the surroundings of the container.

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35. A container as claimed in any one of claims 29-33, wherein the pressure transfer means is arranged as a flexible membrane, preferably constituting a closable lid on the container, adapted to transfer a pressure change of the surroundings of the container to the inside

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of the container, and to separate the inside of the container from the surroundings of the container.

36. A container as claimed in claims 31 or any one of claims 32-35 in combination with claim 31, wherein the inner wall is made of metal, preferably stainless steel.

37. A container as claimed in claim 31 or any one of claims 32-36 in combination with claim 31, wherein the inner wall has a thickness which is at least 5 mm, preferably 5-15 mm, particularly 8-12 mm.

38. A container as claimed in claim 31 or any one of claims 32-37 in combination with claim 31, wherein the insulation is made of a polymer, preferably EPDM (ethylene propylene rubber) or natural rubber.

39. A container as claimed in claim 31 or any one of claims 32-38 in combination with claim 31, wherein the insulation has a thickness which is at least 5 mm, preferably 5-15 mm, particularly 8-12 mm.

40. A container as claimed in any one of claims 29-39, wherein a valve means is arranged on the container to enable discharge of a possible residual volume of air in the container when the container holds the product and a pressure medium.

41. A container as claimed in any one of claims 29-40, wherein the container is adapted to transfer, by the pressure transfer means, a liquid pressure from the outside of the container to a liquid on the inside of the container, said liquid having a freezing point below 0°C, such as ethanol.

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42. A plant for high pressure treatment of products having a temperature below 0°C, comprising a freezing

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device, such as a freezing chamber, and an isostatic press as claimed in any one of claims 1-15.

43. Use of an isostatic press as claimed in any one of claims 1-15 or a container as claimed in any one of claims 29-41 or a plant as claimed in claim 42 for subjecting a product having a temperature below 0°C, such as foods, drugs or cosmetics, to high pressure treatment.